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ABSTRACT

A study was conducted to assess the effect of contrasting mastery learning procedures on the reading achievement of high and low ability students. Subjects were 48 high and 40 low ability first grade students randomly assigned to either a typical commercial basal reading series mastery treatment or an alternative mastery learning treatment that adhered more closely to mastery principles of frequent testing, corrective feedback, and technically sound measurement. Subjects were pretested using the "Passage Reading Test" (PRT) and posttested using the same measure at the end of the mastery treatment. The results indicated that the reading achievement of high ability students was not affected by the type of mastery learning method, whereas the reading achievement of low ability students was improved by the alternative mastery method. (HTH)

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A Comparison of Mastery Learning Procedures Among High and Low Ability Students

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Running Head: Mastery Learning

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Abstract

The purpose of this study was to assess the effect of contrasting mastery learning procedures on achievement among high and low ability students. Subjects were 48 high and 40 low ability first graders, assigned randomly to either a typical, commercial basal reading series mastery learning treatment or an alternative mastery learning treatment that adhered more closely to principles of frequent testing, corrective feedback, and technically sound measurement. Analyses of covariance on two achievement posttests indicated an interaction: The reading achievement of high ability students was not affected by type of mastery learning method, whereas the use of the alternative procedures resulted in better achievement for low ability pupils. Implications for practice are discussed.

A Comparison of Mastery Learning Procedures Among High and Low Ability Students

In A Model for School Learning (1963), John Carroll proposed that degree of school learning is a function of time spent and time needed to learn: Given sufficient (a) opporutnity to learn (allocated quality instructional time) and (b) time actually spent learning (engaged learning time), the great majority of children can achieve some specified criterion level of performance. Bloom (1976) operationalized this conceptual model into an instructional system, referred to as mastery learning, which has been associated with increased student achievement (Lysakowski & Walberg, 1982) and has become one of the most predominant alternatives to traditional pedagogy (Slavin & Karweit, 1984).

As conceptualized by Bloom (1976) and others (see, for example, Block & Burns, 1976), mastery learning entails the following: Material to be learned over a time period is divided into smaller units and performance criteria are established. Following instruction on each learning unit, a test is administered, the results of which provide feedback to teacher and student regarding mastery of the unit and necessary corrective strategies. Corrective feedback is provided until mastery of the learning unit is achieved; then, the student progresses to the next skill in the learning hierarchy. Through this process of formative testing combined with systematic correction of individual learning difficulties, each student should receive appropriate amounts of allocated quality instructional time and proportions of engaged learning time. Bloom (1976) reasoned that, under these conditions, virtually all students could achieve mastery of school curricula.

Given the public press for students to become proficient in reading, it is not surprising that mastery learning has been applied

widely within elementary reading programs. Use of mastery learning systems has been facilitated by the development of mastery learning materials by publishers of basal reading series. Specifically, publishing houses have divided and outlined reading subskills taught within curriculum units, developed end-of-unit and end-of-book tests to measure mastery of those subskills, and designed corrective review strategies to match learning deficits identifiable on the basis of mastery tests.

Unfortunately, several problems have been associated with the substantive nature and the use of these commercial materials. With respect to their content, at least three potential difficulties exist. First, analysis of the subskills addressed and tested in basal reading series suggests that they are sometimes arbitrary and related only indirectly to actual reading behavior (see Fuchs et al., 1983a, 1983b; Tindal et al., 1983a, 1983b). Not surprisingly, then, research indicates that mastery of such subskills correlates inconsistently with global reading achievement (Quilling & Otto, 1971). Second, whereas a basic principle of mastery learning suggests that curriculum be divided into small units, each of which represents a narrowly defined set of skills (Bloom, 1976), the curriculum content of basal series mastery learning units is wide-ranging, with numerous unrelated reading subskills subsumed within single testings (Fuchs et al., 1983a, 1983b; Tindal et al., 1983a, 1983b). Third, the publishers of basal reading mastery tests provide little if any psychometric information (Tindal et al., 1983a). Moreover, recent research on the reliability and criterion validity of such tests indicates great variabilty in technical characteristics, with many indices falling considerably below acceptable levels (Tindal et al., in press). Therefore, the mastery learning tests of many basal reading

series may generate an inadequate or misleading data base for assessing student progress.

In addition to problems associated with the tests themselves, typical use of mastery learning materials may be inconsistent with principles of mastery learning. Within mastery learning programs that promote greater academic achievement than traditional programs, there is strong focus on frequent administration of mastery tests and on employing test results to design corrective strategies for individual students who require them (see Lysakowski & Walberg, 1982). However, as operationalized in typical elementary reading programs, these two tenets of mastery learning appear to be applied loosely. Mastery learning tests are administered at relatively infrequent intervals, at least in part because curricula are divided into broadly focused units. Additionally, students who fail tests may be promoted to new material in the learning hierarchy, regardless of whether corrective strategies are effective or even applied (Slavin & Karweit, 1984; Tindal et al., 1983a).

Given these substantive and procedural problems with the mastery learning materials of commercial basal reading series, alternative measurement methods for evaluating student mastery of reading skills have been developed (see Mirkin et al., 1981). With these contrasting procedures, hereafter referred to as Data-Based Instruction (DBI), important principles of mastery learning are preserved. Regarding the nature of the mastery learning test materials, for example, DBI procedures require (a) assessment of mastery of small units of material, which correlates highly with performance on global reading achievement tests (Fuchs, 1981) and (b) reliable measurement methods (Fuchs, Deno, & Marston, 1983). In terms of how such tests are employed, practitioners (a) administer learning measures frequently, and (b) evaluate test data

systematically, with decision rules for when to advance students to more difficult material and when to introduce corrective strategies, and (c) provide systematic, graphic feedback to students.

DBI has been demonstrated to be highly effective (Fuchs, Deno, & Mirkin, 1984; Fuchs & Fuchs, 1985). Nevertheless, its effectiveness has been tested primarily with special education populations. Moreover, there has been no direct comparison between DBI and those procedures based on the mastery learning materials of the commercial basal reading series. Therefore, it remains unclear how typical basal reading series mastery learning practice compares with these alternative mastery learning procedures within the context of regular classrooms. Additionally, little or no evidence exists concerning the relative effectiveness of mastery learning procedures for students of different abilities (see Lysakowski & Walberg, 1982). Consequently, the first purpose of this study was to compare the effect of mastery learning practices of commercial basal reading series with those of DBI on first grade reading achievement. The second purpose was to assess the relative effectiveness of these contrasting mastery learning methods for high and low ability first grade readers.

Method

Subjects

Subjects were 88 students (45 M, 43 F), who constituted the four first grade classes of a small, rural school district in northeastern Minnesota. The number of children per classroom ranged from 19 to 23. On the Auditory Discrimination, Vocabulary, and Comprehension subtests of the Science Research Associates Reading Achievement Test (Naslund, Thorpe, & Lefever, 1978), subjects scored mean percentiles of 54.42.

67.36, and 50.65, respectively.

The teachers of these students were four Caucasian females who had taught in classrooms for an average of 6.82 years (SD = 1.76). Every teacher formulated four to six homogeneous reading groups of approximately equal size, with each group reading at a different skill level. The reading groups within each of the four classrooms were rank ordered with respect to skill level. Then, a stratified random sampling procedure was employed to assign reading groups to experimental treatments. The stratified sampling insured that each teacher would have equal numbers of groups in each experimental treatment and that each treatment group would comprise equal numbers of groups from the upper and lower halves of the skill rankings.

This random sampling resulted in 49 students in the alternative mastery learning treatment (DBI) and 39 pupils in the typical mastery learning treatment (TYP). Within the DBI group, there were 27 high and 22 low ability students; within the TYP group, there were 21 and 18 students, respectively. Students' average scores on the Passage Reading Test (see measures section) pretest were 57.55 (SD = 43.20) and 86.90 (SD = 89.90), for the DBI and TYP treatment groups, respectively. Mean pretest scores of the 40 low and 48 high ability students were 49.61 (SD = 76.67) and 87.46 (50.46), respectively. A 2 (mastery learning treatment) X 2 (ability group) X 4 (teacher) way analysis of variance conducted on the pretest scores revealed significant differences between the reading skills of students in the ability groups, F (1,70) = 8.42, p .005, and an F ratio approaching significance for the mastery learning treatment factor, F (1,70) = 3.29, p = .074. There was no significant ability by treatment interaction or teacher effect.

Measures

Two type of reading performance measures were used in the study: a curriculum-based basal series mastery test and a curriculum-based passage reading test.

Basal series mastery test. The end-of-level basal mastery test (BMT) of the Houghton Mifflin Reading Series Boats book (Level ; Tests of Basic Reading Skills [Brzeinski & Shoephoerster, 1983]) comprises subtests of word recognition, following directions, beginning and ending digraphs, predicting outcomes, sound associations, noting important details, clusters, multi-meaning words, categorizing, word referents, and drawing conclusions. There are 15 items on one subtest and 5 items on each of the other subtests. The mastery criterion for each subtest and for the total test is 80%. Items require students to respond to auditory stimuli and/or written passages or words: the response format throughout the test is either multiple choice or matching. Internal consistency reliability (Cronbach's alpha) obtained in this study for the pupils' total raw score was between .82 and .96; internal consistency reliability (Kuder-Richardson 20) for the students' total mastery score was between .91 and .95.

Passage reading test. The passage reading test (PRT) employed in the current study requires children to read aloud for one minute a passage from the Boats book (Durr, LePere, Pikulski, & Alsin, 1982). As the student reads, the examiner marks omissions, mispronunciations, repetitions, and substitutions, and then scores performance in terms of the number of correct words read per minute. The 200-word passage was drawn randomly from the Boats text, and represents a readability level of 1.55 (Spache, 1953) over the two 100-word samples. As demonstrated in previous work, test-retest reliability for the PRT is above .90 (Fuchs et

al., 1983). Criterion validity with respect to the Word Identification and Passage Comprehension Tests of the Woodcock Reading Mastery Tests (Woodcock, 1973) ranged between .81 and .92 (Fuchs, 1981).

Procedure

Treatments. In the typical mastery learning treatment (TYP), teachers employd their standard progress monitoring procedures. That is, as reading groups completed mastery learning segments of the curriculum (units and books), teachers administered appropriate mastery tests provided by the curriculum publishers. Depending on group performance, decisions were formulated concerning promotion to more difficult reading material and/or corrective review work, and these decisions were communicated to students. Through the course of the study, teachers recorded, for each student, test scores and related promotion decisions. After the study, these scores and decisions were inspected and summarized by two independent raters with 100% agreement. (Agreement was calculated using the following formula from Coulter citer in Thompson, White, & Morgan, 1982: Percentage = agreements between Rater A and Rater B/ agreements between A and B + disagreements between A and B + omissions by A + omissions by B.) This summary indicated that across 5 to 8 tests administered during the duration of the investigation, (a) teachers' decisions were to promote all students to successive learning units following administration of each mastery learning test, despite that (b) averages of 27.0% and 61.5% of high and low ability students, respectively, actually failed mastery learning tests. Thus, important dimensions of the TYP treatment included: measurement on basal mastery tests every 4 to 6 weeks, verbal feedback to students every 4 to 6 weeks, and promotion before or without corrective feedback.

In the alternative mastery learning treatment (DBI), teachers first determined an end-of-year reading goal for each reading group, which specified the number of stories in the reading series to be completed by the end of the year. Then, teachers established for each group a graph that (a) displayed progress across time through the number of stories to be completed and (b) showed an aimline indicating the expected rate of progress through the stories. Every week, teachers measured each student's correct performance rate on a reading passage randomly sampled from the group's current instructional level story. If at least 80% of the students in the group read at least 50 words correct per minute on the sample, then the teacher moved the group to the next story in the curriculum. Otherwise, the teacher involved the group in corrective instruction on the same story. Following each measurement, teachers charted the group's collective progress on the graph, and graphs were shared with students. Thus, essential dimensions of DBI included: weekly measurement on oral reading passages, weekly graphic feedback, and corrective feedback and testing as required before promotion to more difficult material.

Data collection. Before the study began, aides trained in test administration procedures administered the PRT individually to students using a standard format (see Mirkin et al., 1981). Following the study, these aides readministered the PRT individually to students employing the standard format and administered the BMT under standard conditions to students in groups of approximately 20 students.

Data analysis. Given initial differences in the reading skills of the two mastery learning treatment groups, as indicated on the PRT, the PRT and BMT posttest raw scores were analyzed with a 2 X 2 X 4 way analysis of covariance. The experimental factor was the mastery learning

treatment (DBI vs. TYP), the blocking factors were ability (high vs. low) and teacher (1 vs. 2 vs. 3 vs. 4), and the covariate was the PRT pretest score. Because the teacher factor was not a variable of interest, but rather was employed only to partial out a potential source of variance, results associated with the teacher factor are not presented or discussed below.

Results

Table 1 displays means, adjusted means, and standard deviations on the PRT and BMT raw scores for the mastery learning and ability conditions. The analyses of covariance conducted on the BMT scores revealed a significant effect for treatment, F (1,71) = 6.10, p .05, and for ability, F (1,17) = 20.06, p .001. Additionally, there was a significant treatment X ability interaction, F (1,71) = 4,02, p .05. With respect to the PRT scores, there was a significant treatment X ability interaction, F (1,71) = 3.98, p .05. The interactions for the BMT and PRT measures are displayed on Figures 1 and 2, respectively. As indicated by these figures, the achievement of the two mastery learning groups was similar for high ability students; however, low ability students achieved better in the DBI than in the TYP mastery learning treatment.

Insert Table 1 and Figures 1 and 2 about here

Discussion

The significant treatment by ability interactions, replicated

across the two measures, indicate that, within regular education classrooms, the reading achievement of high ability students was not affected by type of mastery learning method. However, for low ability pupils, the use of the alternative mastery learning procedures, DBI, resulted in better achievement than did the use of more typical mastery learning procedures. The alternative mastery learning system, DBI, may be differentiated from typical mastery learning systems along several dimensions. First, the curriculum units assessed in each mastery test were (a) smaller, (b) more narrowly focused, and (c) better related to global reading achievement than in the typical mastery learning treatment. Second and relatedly, data collection and decisions were more frequent in the alternative mastery learning system and thereby provided a richer and more adequate decisionmaking data base. Third, evaluation of data was more systematic: In the alternative system, decisions were dictatated by rules (i.e., 80% of the group had to perform at or above the criterion level), whereas in the typical mastery learning treatment teachers were free to use their judgment concerning when to romote students to more difficult material. Inspection of teachers' decisions suggests that their judgment often was inadequate: They advanced students through the curriculum despite high percentages of failing performances on the mastery tests. Fourth, in the alternative mastery learning treatment, feedback to teachers and students was more frequent and graphic. Finally, testing procedures in the alternative treatment demonstrates reliability and validity; mastery tests associated with the Houghton Mifflin series in the typical mastery learning treatment are of questionable technical adequacy (Tindal et al., in press).

The methodology employed in the current study precludes analysis of which dimension(s) of the alternative treatment actually accounted for

the differential achievement among the low ability students. Additional research might explore this issue through the use of multivariate correlational analysis. Nevertheless, the current investigation does suggest that when principles of mastery learning are adhered to more rigorously, as in the alternative mastery learning system, achievement among low ability students is enhanced. Simultaneously, results indicate that teachers of low ability beginning readers might exercise caution in their use of commercial basal reading series mastery learning materials and might consider the employment of alternative, more rigorous mastery learning methods, such as DBI, to produce better achievement among their poorer readers.

In a more general way, results add to a growing body of evidence indicating that high and low ability students perform differentially under varying instructional conditions (see Snow & Lohman, 1984), and that low achievers may require more direct, structured, elaborated instruction (Snow & Lohman, 1984) and more frequent, detailed, clear feedback (Clifford, 1984). Furthermore, given the assumption that low achievers have earned their status because of the relative ineffectiveness of the standard instructional treatment, it stands to reason that a measurement methodology that facilitates more systematic, frequent evaluation and empirical development of alternative programs would enhance low achievers' progress. In contradistinction, high achievers have earned their status due to the relative efficacy of the traditional instructional program, and therefore one would not expect more adequate and frequent formative testing to produce important progammatic modifications or resulting differential achievement.

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Table 1

Means, Standard Deviations, and Adjusted Means[a] on Posttest PRT and BMT Scores for Treatment and Ability Groups

	PRT			BMT		
Group	Mean	SD	Adjusted Mean	Mean	SD	Adjusted Mean
High ability	113.23	30.56	112.87	63.65	1.71	63.50
Low ability	76.90	23.32	78.07	58.76	7.94	58.90
DBI[b]	95.66	26.65	97.92	62.19	4.97	62.51
TYP[c]	99.61	39.85	95.96	60.53	6.97	60.10

[a]Adjusted for covariate and other factors.

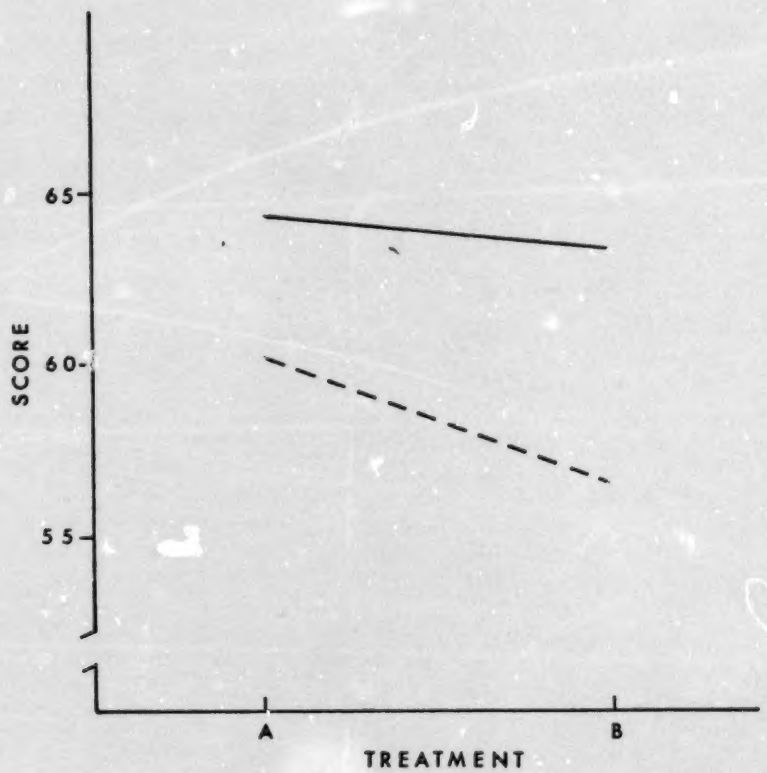
[b]Data-based instruction, the alternative mastery learning condition.

[c]The typical mastery learning condition.

Figure Captions

Figure 1. BMT scores for DBI (A) and TYP (B) conditions for high (——) and low (-----) ability pupils.

Figure 2. PRT scores for DBI (A) and TYP (B) conditions for high (——) and low (-----) ability pupils.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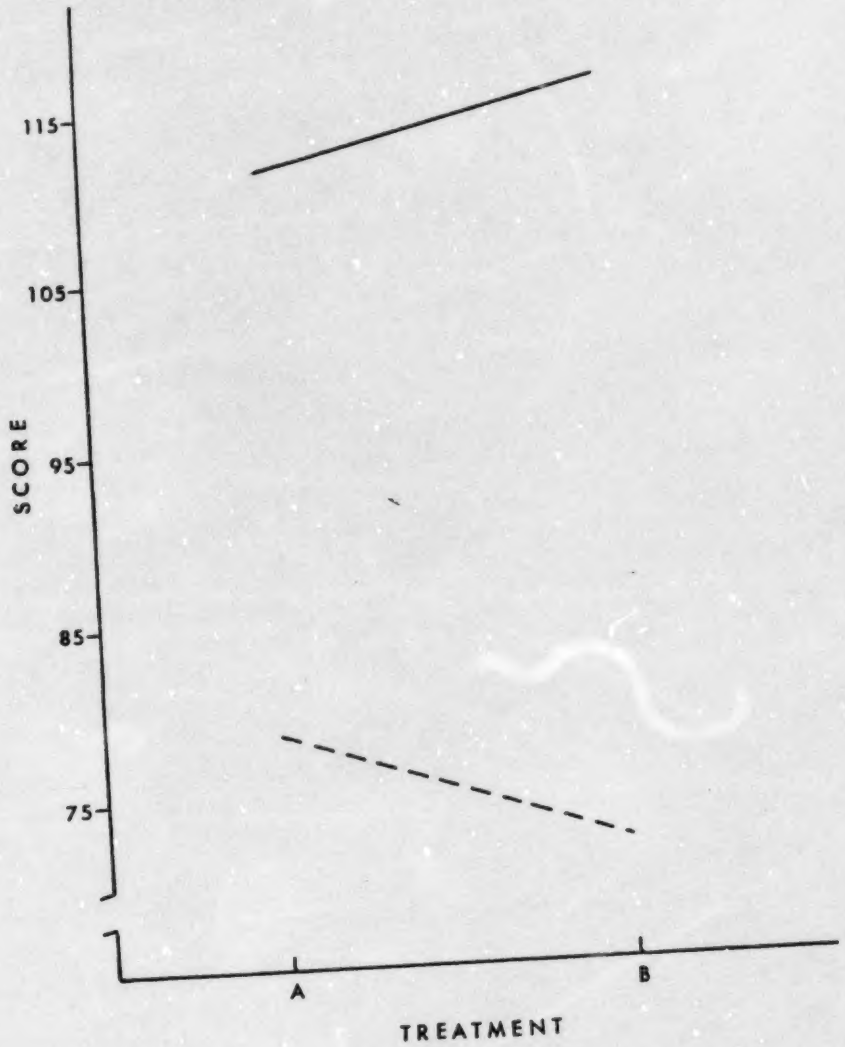
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